

CONSIDERED DESIGN CHANGES - WEIGHT REDUCTION (REV. A)

25 July 1960

<u>Item</u>	<u>Current Est. Wt. (lbs)</u>	<u>Proposed Changes (lbs.)</u>			
		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
1. <u>Compressor Inlet Section</u>	<u>146.2</u>				
(a) Remove thrust balance seal (see rotor item 3 (d))		-1.9			
(b) Titanium inlet case		-38.5*			
(c) Redesign #1 bearing compartment		prel.			
		-3			
2. <u>Compressor Stator</u>	<u>443.5</u>				
(a) Change 1st Stage comp. case, vanes to Titanium		-27.2*			
		prel.			
(b) Thin inner by-pass gap fairing		-.7			
		prel.			
3. <u>Compressor Rotor</u>	<u>1174.3</u>				
(a) Astroloy compressor disc					-76**
					prel.
(b) Thin rotor flanges					-2.5
					prel.
(c) Incorporate Inco 718 in blades and shorten rotor					-18
					prel.
(d) Remove 1st Stage inlet seal		-3.3			
(e) Titanium 1st stage blade		-33.5*			
		prel.			

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Proposed Changes (lbs.)

Item	Est. wt. (lbs.)	Proposed Changes (lbs.)			
		Cat. 1	Cat. 2	Cat. 3	Cat. 4
(f) Trussed front hub in Waspaloy with Titanium blades		-4.5*			
(g) Integral Spacers on 8th disc and shorter bolts		-10 prel.			
(h) Taper 9th stage seals		(-.2 incorporated)			
(i) Remove rear hub excess material		-4 prel.			
(j) Redesign discs 2 thru 4 to remove excess for gyro and pressure <u>and add rim spacer.</u>		+7.4			
4. <u>Compressor Miscellaneous</u>	6				
5. <u>Diffuser Section</u>	474.5				
(a) Lighten struts		-1.6 prel.			
(b) Redesign #2 bearing and bearing compartment		-24 prel.			
(c) Redesign tower shaft gearing		-4.6			
(d) Lightened bosses					(proposal dropped)
6. <u>Burner Nozzles and Manifolds</u>	47.3				
(a) Pintle nozzles				-5 prel.	

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 Proposed Changes (lbs.)
Est. Wt. (lbs.) Cat. 1 Cat. 2 Cat. 3 Cat. 4

7. <u>Burner Cans</u>	153.8				
(a) Thin burner can supports		-2.8			
(b) Remove rear burner clamps and flange		-5 <u>prel.</u>			
(c) Annular burners					NA
8. <u>Outer Burner Case</u>	90.1				
(a) Reduce flanges and bolts		(proposal dropped)			
(b) Astroley burner case					-10** prel.
(c) Lighten drain bosses		-.2 <u>prel.</u>			
9. <u>Inner Burner Case</u>	56.2				
(a) Thin inner burner case corrugated stiffener to .010			-5 <u>prel.</u>		
(b) Thin diaphragm support					NA
10. <u>Burner Miscellaneous</u>	21.6				
11. <u>Transition Ducts</u>	86.7				
(a) Thin outer duct from .071 to .056" min.		-9			

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Item	Est. Wt. (lbs)	Cat. 1	Cat. 2	Cat. 3	Cat. 4
12. <u>Turbine Nozzles</u>	293.8				
(a) Redesign transition duct to nozzle seals			-15. prel.		
13. <u>Turbine Case</u>	92.4				
14. <u>Turbine Rotor</u>	681.3				
(a) Redesign blade root to exploit Astroloy (1st stage)		-29 prel.			
(b) Thin rotor flanges and pilots					(proposal dropped)
(c) Thin turbine shafts seals		-2.1 prel.			
(d) Thin 2nd stage rotor rear seal		-.7 prel.			
(e) Thin balance flange on turbine shaft		-1.4 prel.			
(f) Redesign 2nd stage root to exploit Astroloy		-5.6 prel.			
(g) Eliminate 1st stage cover plate and duct					<u>NA</u>
15. <u>Turbine Exhaust</u>	412.6				
(a) Sandwich const. inner turbine exhaust duct					-10** prel.
(b) Thin turbine exhaust struts to .032 min.		-2.8			

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Item	Proposed Changes (lbs.)				
	Est. Wt. (lbs.)	Cat. 1	Cat. 2	Cat. 3	Cat. 4
(c) Thin outer turbine exhaust ducts to .038 min.		-5.3			
(d) Astroloy rear mount ring					-10** prel.
(e) Thin turbine exhaust case rear flange		-5.2 prel.			
(f) Thin #3 bearing support flange					-4
(g) Redesign #3 bearing and bearing compartment					-3** prel.
(h) By-pass bleed re-entry		-4 prel.			
16. <u>Turbine Miscellaneous</u>	12				
17. <u>A/B Diffuser Section</u>	166.2				
(a) Thin case to .032 min. Reduce flanges and bolts		-9			
(b) Sandwich construction inner cone and diaphragm					-8
(c) A/B Variable area fuel nozzles		-35 prel.			
18. <u>A/B Ducts and Liners</u>	257.4				
(a) Thin ducts		-12			

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		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
(b) Scallop flanges and reduce bolt sizes		-2 prel.			
(c) Substitute Astreloy sheet in duct					-15** prel.
19. <u>A/B Nozzle</u>	<u>432.5</u>				
(a) Reduce bolt sizes		(proposal dropped)			
(b) Waspaloy A/B nozzle support cone		-3.4			
(c) Lighten nozzle segment rollers					-4 prel.
(d) Lighten nozzle segments with PDRL-100		-24.5 prel.			
(e) Thin support front flange		-2.7 prel.			
20. <u>A/B Actuating System</u>	<u>47.4</u>				
(a) Lighten A/B nozzle actuators					NA
(b) Remove A/B actuator, use 3					(proposal dropped)
21. <u>A/B Miscellaneous</u>	7				
22. <u>Hydraulic System</u>	<u>106.9</u>				
23. <u>Ignition System</u>	33				

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Item	Current Est. Wt. (lbs.)	Proposed Changes (lbs.)			
		Cat. 1	Cat. 2	Cat. 3	Cat. 4
24. <u>Accessories Drive</u>	<u>116.5</u>				
(a) Gearbox		-5.8			
(b) Change to Ti covers and supports		prel.			
25. <u>Engine Accessories</u>	<u>304.4</u>				
(a) Lighten lube pump with Ti sheet housing					-3 prel.
(b) Titanium P & D valve housing					-2 prel.
(c) Titanium lube tank					-4** prel.
(d) Change to controlled tubing		-5 prel.			
26. <u>A/B Accessories</u>	<u>222.6</u>				
(a) Single stage A/B fuel pump		-4 prel.			
27. <u>By-Pass System</u>	<u>266</u>				
(a) By-pass mechanism and ducts			-15 prel.		
(b) Eliminate front transition ducts			-38 prel.		
28. <u>Experience Factor</u>	<u>20</u>				
Revision in Waspaloy density					
ADDITIVE TOTALS	<u>6112</u>	<u>-366.6</u>	<u>-73.0</u>	<u>0.0</u>	<u>-165.9</u>

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CODE : (1) Prel. = Preliminary estimate not substantiated by design layout.

(2) NA = Weight estimate not yet available.

(3) * = subject to compromise.

(4) ** = Costly material change involved.

(5) — = Revisions since 1 July 1960.

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